“Sound Editing and Compositing from Variable Acoustic Sources”

UROP Narrative Report by William Brueggemann

April 25, 2017

In the spring semester of 2017, I collaborated with my faculty mentor Dr. Justin Rubin to assemble a 65-70 minute album of his original music. Recorded in different locations, acoustic spaces and to varying degrees of fidelity, I was tasked with not only editing these recordings but through the utilization of modern digital recording software, altering each track to best achieve a unified aesthetic and a cohesive sound. This process proved to be both an incredible challenge as well as a profound learning experience for me as a budding audio engineer.

When I first set out to prepare for the research component of this grant I suspected that I would, through careful study and exhaustive exploration of existing texts, gain the majority of applicable skills required for a project like this. What I quickly learned was that despite my prior experience in this field and the many excellent resources at my disposal, there was still so much left for me to learn. This project pushed me to the limits of what I had thought possible and required me to take chances and experiment outside of what would be conventional in the realm of audio recording.

In November of 2016 I assisted Dr. Rubin in the engineering of a live recording on pianist Solon Pierce in Weber Music Hall. Though I had been a part of recordings before, this was the first time I had the opportunity to record using professional equipment and to record a musician of that caliber. There were several issues that came up during this recording session that involved a certain kind of ambient sound from the hall itself as the wood in the ceiling began

to creak in response to heat from the sunlight. We attempted to adjust microphone placement and wait for moments of quiet to begin recording.

This lead to a series of recordings that captured excellent playing but an array of audio issues from pops and clips from the room as well as human noise. While the fidelity of these tracks was quite good, I knew that it would require major editing and audio production "wizardry" to overcome these substantial issues as well as maintaining the best performances from each take. From this session, I took the unbroken WAV file which was over 2 hours in length and edited together bits and pieces from each take to assemble 3 finished pieces each only 5-8 minutes in length. These edits were a challenge because of all the popping sounds from Weber Hall as well as the fact that there were 4 mic placements and numerous takes of each piece.

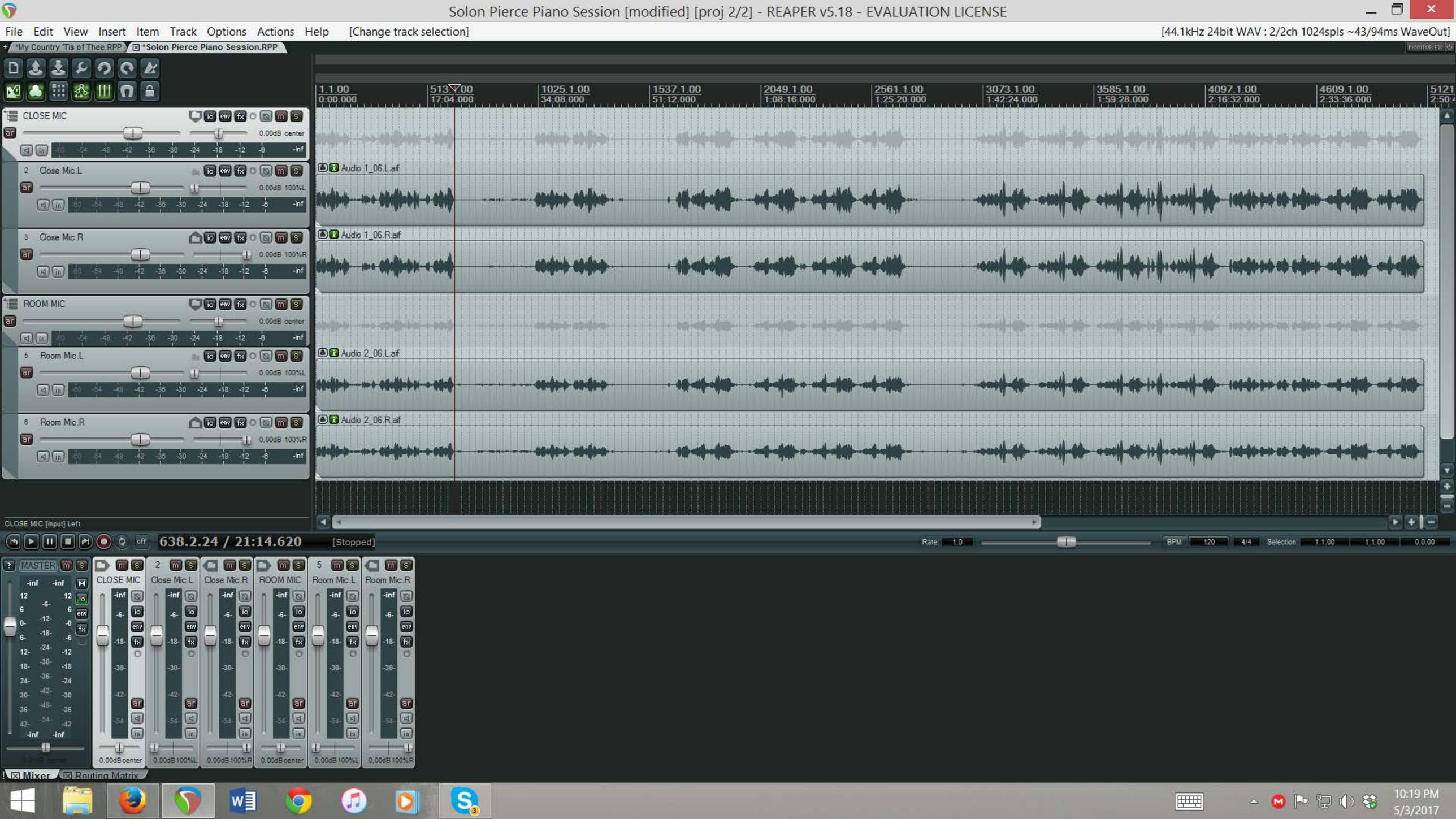
When the editing was complete, I worked with Dr. Rubin to address any notes he had in terms of performance and fidelity issues. I then went on to edit the many other recordings which he had previously accrued from players and colleagues around the U.S. and beyond. The challenge with these edits were the result of a lack of consistency between acoustic spaces, microphone placements, quality of engineering and number of performances ("takes") of each piece. This meant that each session required different solutions to ensure that the best sound possible would be the result. In some cases, I employed digital equalization to boost or reduce certain frequencies that contributed to white noise or distortion. In other cases, I added some reverberation synthesis or "Reverb" to the pieces that were recorded in a smaller space in order to match them with the sound of Weber hall.

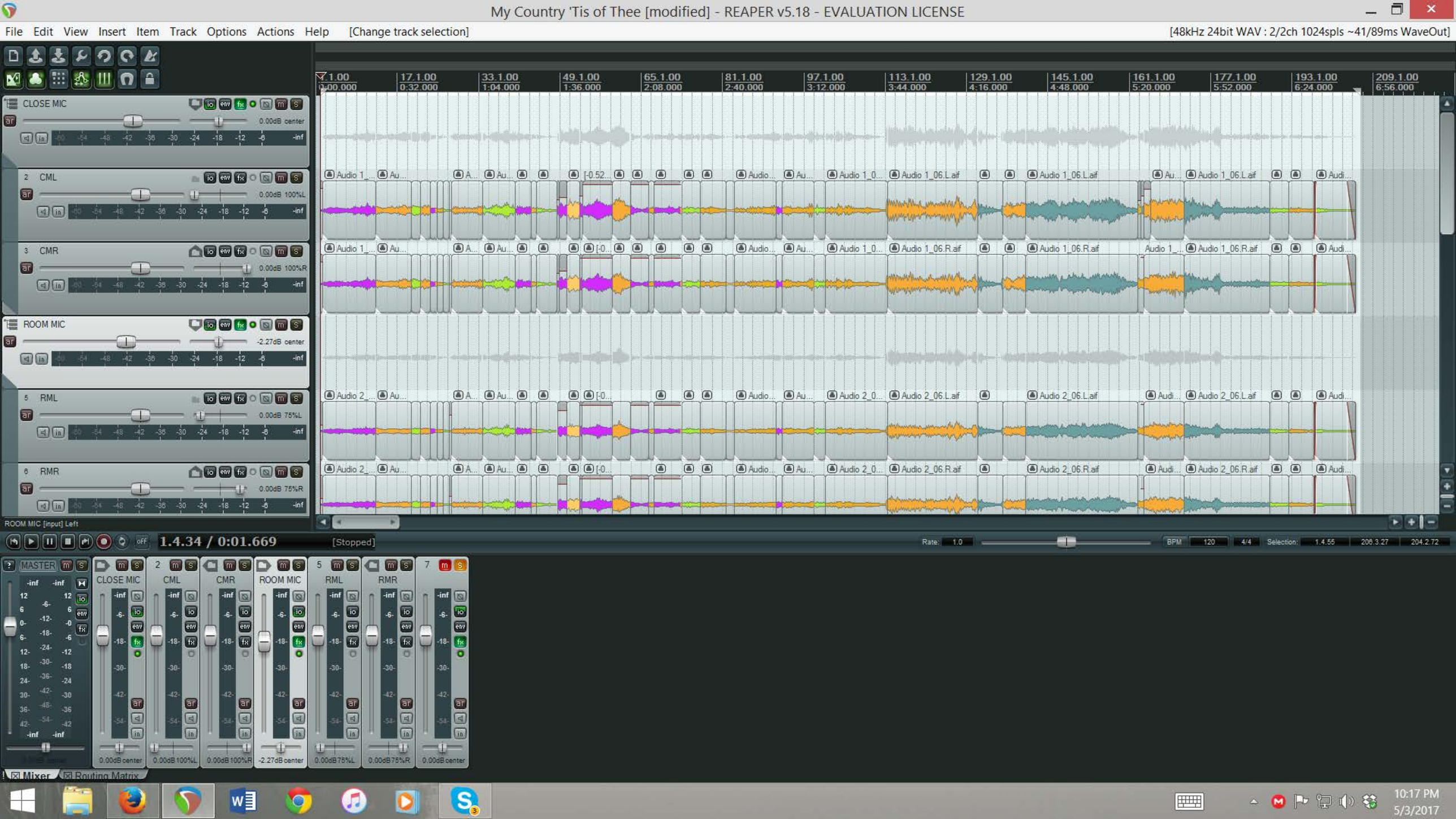
Much of this work was incredibly tedious and required hours of trial and error to uncover each solution. What most surprised me was that the information I had been learning to prepare

for this (which included many conversations with UMD's own audio expert Donald Schraufnagel) was for the most part, unrelated to the specific issues I encountered in mixing and mastering these recordings. The largest and most insightful component of "research" came from my own hours of experimentation and invaluable experience of working on the actual music files. Much of what I had learned, such as the function of compression, limiting, equalization, microphone usage and the study of acoustics, was still very important to my development as a thoughtful musician and producer but I was surprised at how much simply required hands-on experience.

After all of the music was assembled and mixed, I performed the final step of mastering the finished audio tracks. This step involved the "normalization" process which simply means ensuring that each piece has an appropriate amount of dynamic range while still maintaining relative consistency between tracks and within a single piece. I experimented with many different processes for mastering including the use of limiters and compressors which aim to equalize the differences in volumes within a single sound-wave recording. I used the VST plug-in "Elephant" by Voxengo to apply some subtle limiting to certain tracks to boost their volume, optimizing them for a multitude of platforms. In some cases, I opted to adjust volumes manually using "volume envelopes" to ensure that there was no loss in fidelity or timbre.

In the end, I have assembled 18 finished tracks of music all from different sources and refined them to have a complimentary (if not identical) acoustical and musical aesthetic. I am proud of the results of this research project, especially considering how far these recordings have come in terms of quality. The experiences and lessons I have learned are invaluable to me and will hopefully build the essential foundations of my career as a musician, composer and audio production engineer.


Solon Pierce Piano Session [modified] [proj 2/2] - REAPER v5.18 - EVALUATION LICENSE
File Edit View Insert Item Track Options Actions Help [Change track selection]
[44.1kHz 24bit WAV : 2/2ch 1024spls ~43/94ms WaveOut]
*My Country 'Tis of Thee.RPP
*Solon Pierce Piano Session.RPP
CLOSE MIC
Close Mic.L
Close Mic.R
ROOM MIC
Room Mic.L
Room Mic.R
Audio 1_06.L.aif
Audio 1_06.R.aif
Audio 2_06.L.aif
Audio 2_06.R.aif
638.2.24 / 21:14.620
[Stopped]
MASTER
Mixer
Routing Matrix
10:19 PM
5/3/2017


My Country 'Tis of Thee [modified] - REAPER v5.18 - EVALUATION LICENSE
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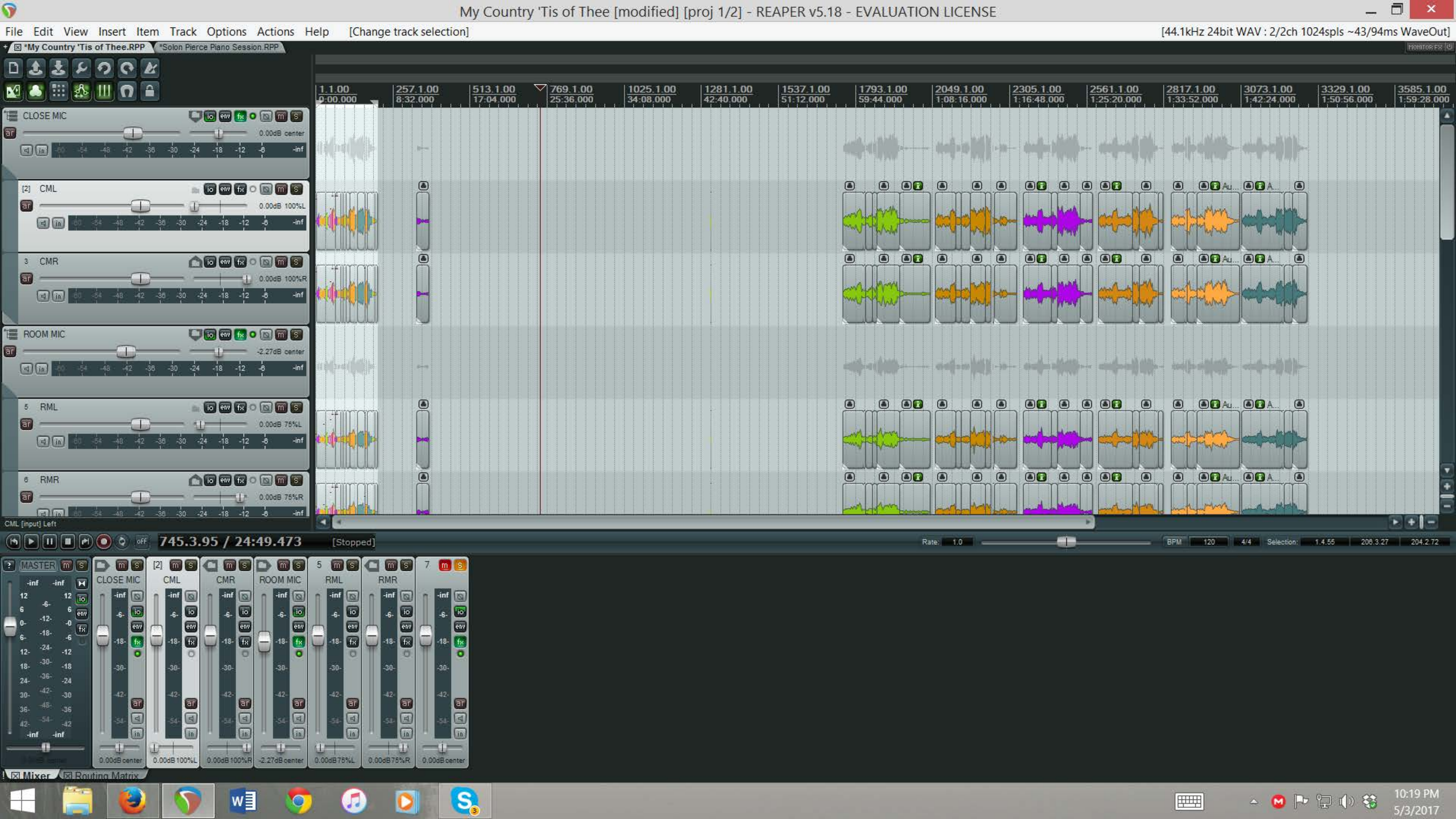
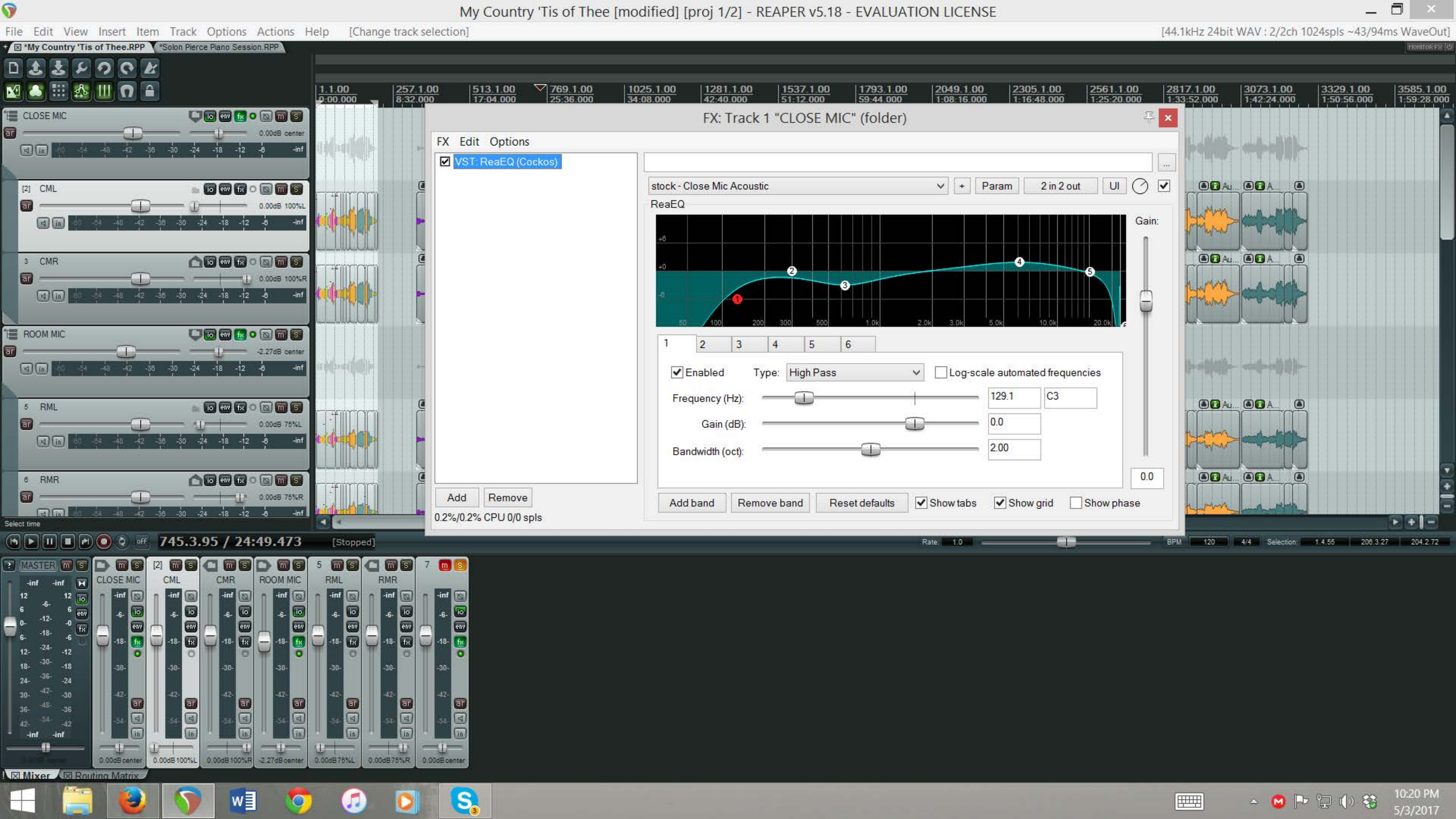
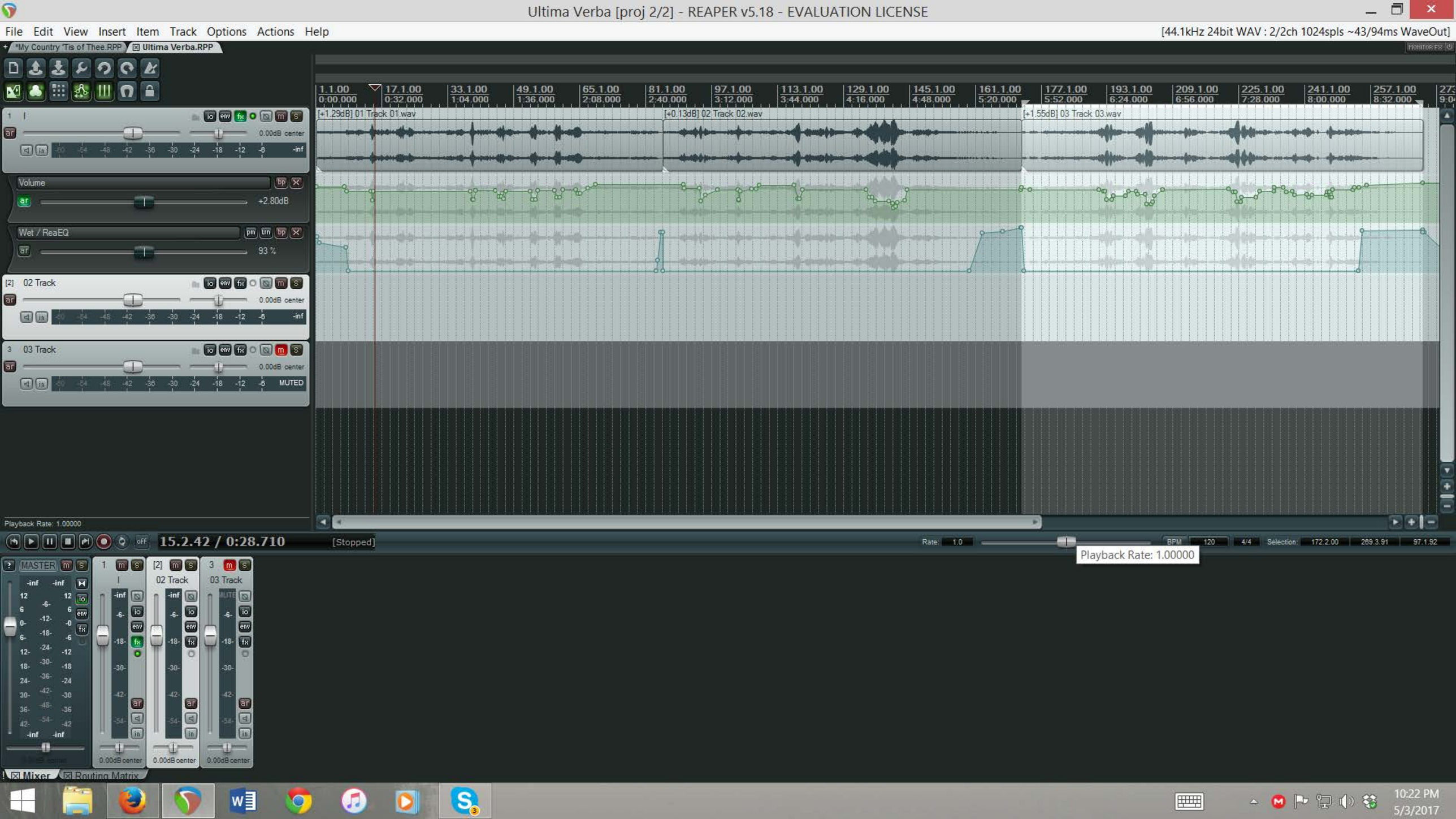
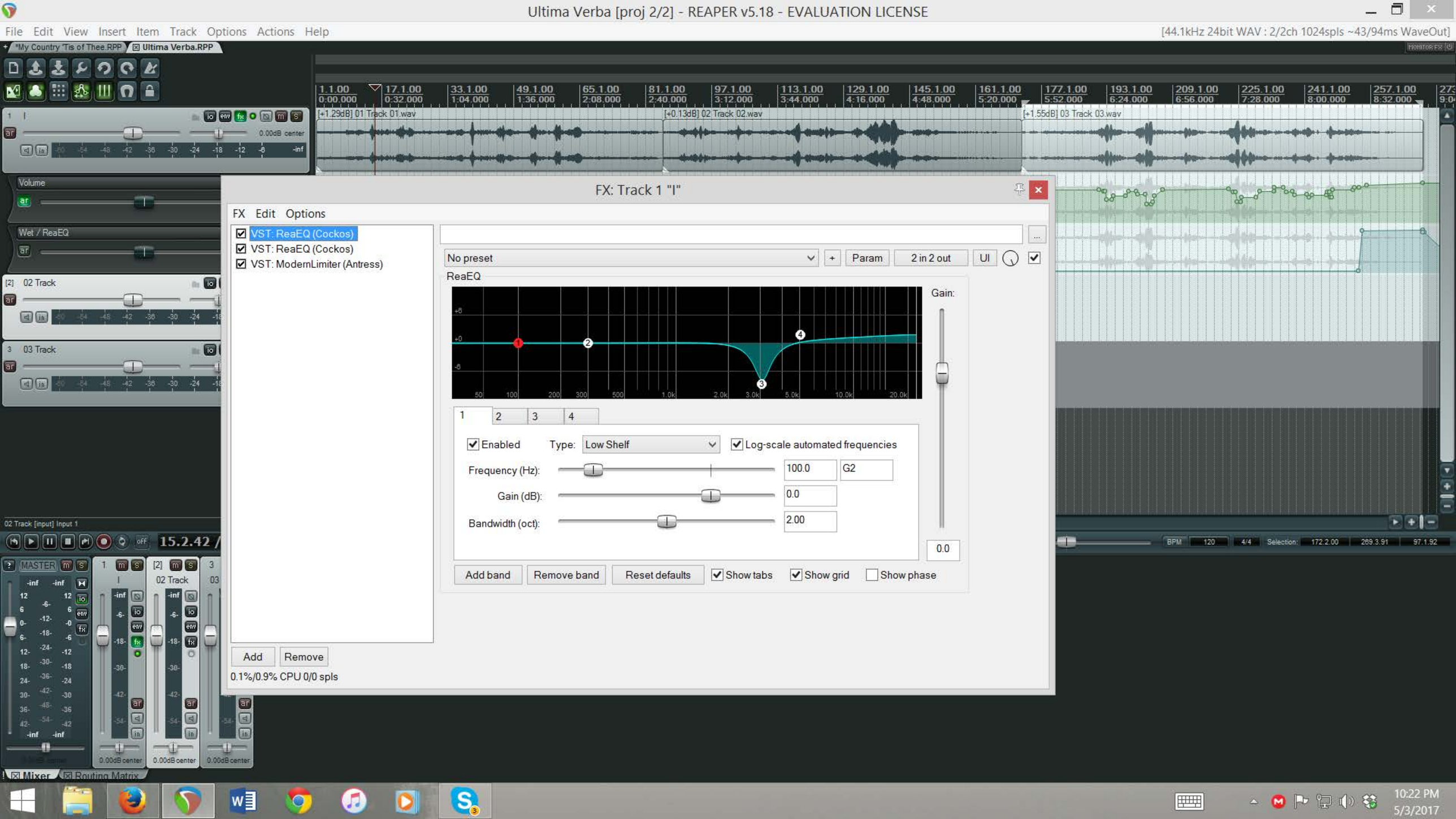
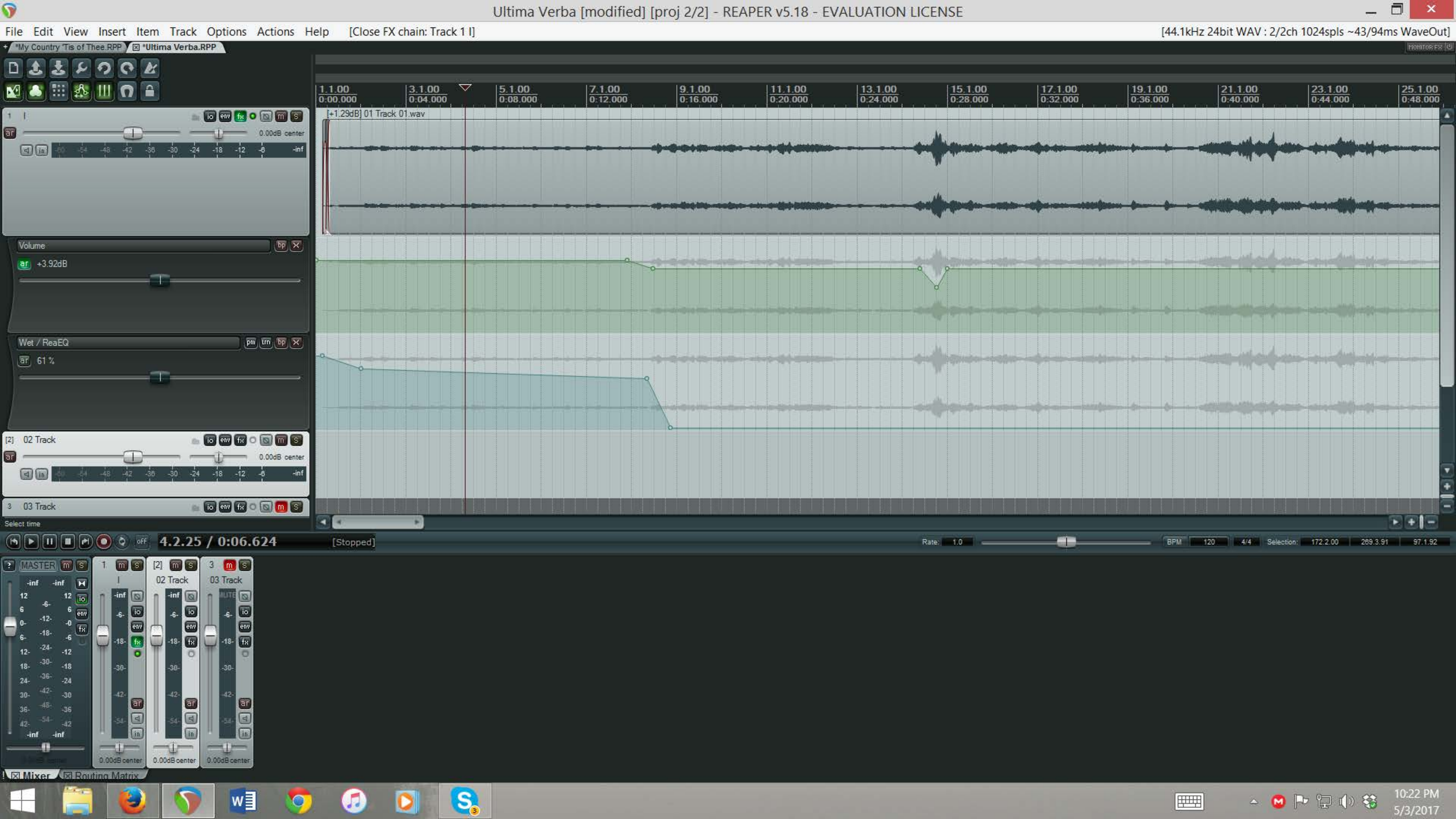
CLOSE MIC
0.00dB center
2 CML
0.00dB 100%L
3 CMR
0.00dB 100%R
ROOM MIC
-2.27dB center
5 RML
0.00dB 75%L
6 RMR
0.00dB 75%R
ROOM MIC [input] Left
1.4.34 / 0:01.669
[Stopped]
MASTER
Mixer
Routing Matrix
10:17 PM
5/3/2017


My Country 'Tis of Thee [modified] [proj 1/2] - REAPER v5.18 - EVALUATION LICENSE
File Edit View Insert Item Track Options Actions Help [Change track selection]
[44.1kHz 24bit WAV : 2/2ch 1024spls ~43/94ms WaveOut]
*My Country 'Tis of Thee.RPP
*Solon Pierce Piano Session.RPP
CLOSE MIC
[2] CML
3 CMR
ROOM MIC
5 RML
6 RMR
1.1.00 0:00.000
257.1.00 8:32.000
513.1.00 17:04.000
769.1.00 25:36.000
1025.1.00 34:08.000
1281.1.00 42:40.000
1537.1.00 51:12.000
1793.1.00 59:44.000
2049.1.00 1:08:16.000
2305.1.00 1:16:48.000
2561.1.00 1:25:20.000
2817.1.00 1:33:52.000
3073.1.00 1:42:24.000
3329.1.00 1:50:56.000
3585.1.00 1:59:28.000
CML [input] Left
745.3.95 / 24:49.473
[Stopped]
MASTER
CLOSE MIC
CML
CMR
ROOM MIC
RML
RMR
7
Mixer
Routing Matrix
10:19 PM
5/3/2017


My Country 'Tis of Thee [modified] [proj 1/2] - REAPER v5.18 - EVALUATION LICENSE
File Edit View Insert Item Track Options Actions Help [Change track selection]
[44.1kHz 24bit WAV : 2/2ch 1024spls ~43/94ms WaveOut]
*My Country 'Tis of Thee.RPP
*Solon Pierce Piano Session.RPP
CLOSE MIC
CML
CMR
ROOM MIC
RML
RMR
FX: Track 1 "CLOSE MIC" (folder)
FX Edit Options
VST: ReaEQ (Cockos)
stock - Close Mic Acoustic
Param
2 in 2 out
UI
ReaEQ
Gain:
Enabled
Type: High Pass
Log-scale automated frequencies
Frequency (Hz): 129.1 C3
Gain (dB): 0.0
Bandwidth (oct): 2.00
Add band
Remove band
Reset defaults
Show tabs
Show grid
Show phase
Add
Remove
0.2%/0.2% CPU 0/0 spls
745.3.95 / 24:49.473
[Stopped]
MASTER
Mixer
Routing Matrix
10:20 PM
5/3/2017


Ultima Verba [proj 2/2] - REAPER v5.18 - EVALUATION LICENSE
File Edit View Insert Item Track Options Actions Help
[44.1kHz 24bit WAV : 2/2ch 1024spls ~43/94ms WaveOut]
*My Country 'Tis of Thee.RPP
Ultima Verba.RPP
0.00dB center
Volume
+2.80dB
Wet / ReaEQ
93 %
02 Track
03 Track
MUTED
[+1.29dB] 01 Track 01.wav
[+0.13dB] 02 Track 02.wav
[+1.55dB] 03 Track 03.wav
Playback Rate: 1.00000
15.2.42 / 0:28.710
[Stopped]
Rate: 1.0
BPM 120 4/4
Selection: 172.2.00 269.3.91 97.1.92
Playback Rate: 1.00000
MASTER
Mixer
Routing Matrix
10:22 PM
5/3/2017


Ultima Verba [proj 2/2] - REAPER v5.18 - EVALUATION LICENSE
File Edit View Insert Item Track Options Actions Help
[44.1kHz 24bit WAV : 2/2ch 1024spls ~43/94ms WaveOut]
*My Country 'Tis of Thee.RPP
Ultima Verba.RPP
[+1.29dB] 01 Track 01.wav
[+0.13dB] 02 Track 02.wav
[+1.55dB] 03 Track 03.wav
FX: Track 1 "I"
FX Edit Options
VST: ReaEQ (Cockos)
VST: ReaEQ (Cockos)
VST: ModernLimiter (Antress)
Add
Remove
0.1%/0.9% CPU 0/0 spls
No preset
Param
2 in 2 out
UI
ReaEQ
Gain:
Enabled
Type:
Low Shelf
Log-scale automated frequencies
Frequency (Hz):
100.0
G2
Gain (dB):
0.0
Bandwidth (oct):
2.00
Add band
Remove band
Reset defaults
Show tabs
Show grid
Show phase
Volume
Wet / ReaEQ
02 Track
03 Track
MASTER
Mixer
Routing Matrix
10:22 PM
5/3/2017


Ultima Verba [modified] [proj 2/2] - REAPER v5.18 - EVALUATION LICENSE
File Edit View Insert Item Track Options Actions Help [Close FX chain: Track 1 I]
[44.1kHz 24bit WAV : 2/2ch 1024spls ~43/94ms WaveOut]
*My Country 'Tis of Thee.RPP
*Ultima Verba.RPP
1.1.00 0:00.000
3.1.00 0:04.000
5.1.00 0:08.000
7.1.00 0:12.000
9.1.00 0:16.000
11.1.00 0:20.000
13.1.00 0:24.000
15.1.00 0:28.000
17.1.00 0:32.000
19.1.00 0:36.000
21.1.00 0:40.000
23.1.00 0:44.000
25.1.00 0:48.000
[+1.29dB] 01 Track 01.wav
0.00dB center
Volume
+3.92dB
Wet / ReaEQ
61 %
02 Track
03 Track
Select time
4.2.25 / 0:06.624
[Stopped]
Rate: 1.0
BPM 120 4/4
Selection: 172.2.00 269.3.91 97.1.92
MASTER
Mixer
Routing Matrix
10:22 PM
5/3/2017